



Chapter 18: Firefighting, Rescue and Assistance



Overview

Introduction

As members of the U.S. Coast Guard and the Auxiliary, the boat crews have an important responsibility in maintaining their vessel and assisting those in distress. A primary responsibility of a boat crew is to save **lives**, not **property**. However, when and where possible, a boat crew will attempt to save property. Boat crew members may be called upon to react to a fire on their own boat, dewater vessels, and right vessels. This chapter discusses:

- safety and prevention measures to take when on a boat or assisting a distressed vessel;
- how to assess emergency situations;
- how to prevent, identify, and extinguish boat fires;
- how to dewater vessels; and
- several methods on how to right overturned vessels.

It is very important to keep in mind that any vessel can fall victim to tragedy when proper prevention measures or rescue procedures are not followed correctly and precisely.

In this chapter

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Section A. Safety and Damage Control

Overview

Introduction

Safety is paramount during all emergencies evaluations that you will be involved in as a member of a boat crew. Mishaps resulting in death or injury have occurred when boat crews responded to vessels in distress. Nearly every mishap that resulted in serious injuries had a common denominator. Serious injuries happen when common sense and a continuing regard for safety give way to reckless urgency.

As a boat crew member, your primary responsibility in emergency assistance is saving **lives**, not property. Boat crews must be aware of their limited roles in emergency assistance, particularly when responding to fire emergencies. Safety begins with assessing your primary responsibilities and capabilities for the variety of emergency situations you will encounter.

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Coast Guard Firefighting Activities Policy

A.1. Coast Guard firefighting activities policy

Among the provisions of the Ports and Waterways Safety Act of 1972 (PWSA) (33 U.S.C. 1221 *et seq.*) is an acknowledgment that increased supervision of port operations is necessary to prevent damage to structures in, on, or adjacent to the navigable waters of the United States, and to reduce the possibility of vessel or cargo loss, damage to life, property, and the marine environment. This statute, along with the traditional functions and powers of the Coast Guard to render aid and save property (14 U.S.C. 88(b)), is the basis for Coast Guard firefighting activities.

The Coast Guard has traditionally provided fire fighting equipment and training to protect the lives of Coast Guard personnel, its vessels, and property. Coast Guard and Auxiliary units are also called upon to assist in fighting major fires on board other vessels and at waterfront facilities. Although the Coast Guard will help fight fires involving vessels or waterfront facilities, it is not a primary response capability. Local authorities are responsible for maintaining adequate firefighting capabilities in U.S. ports and harbors. The Coast Guard renders assistance as time and resources are available, based on the level of personnel training and adequacy of equipment available for a specific situation at hand.



Safety Assessment and Management Guidelines

A.2. Safety assessment and management guidelines Emergency situations can cause people to panic or act before thinking despite the best of training and preparation. Therefore, boat crews must work together as a team to minimize any potential or immediate jeopardy for both civilian casualties and themselves. **Never** enter an emergency situation without first assessing the risk involved for the boat crew members and civilian victims (**Risk Assessment**), always be aware of the dynamics of the emergency situation (**Situational Awareness**), and implement a control plan that fits each unique **emergency** (**Damage Control Risk Management**).

A.2.a. Risk assessment and management

Risk Assessment starts with realizing why mishaps occur. The responsibility for identifying and managing risk lies with every member of a boat crew. Realistic training based on standard techniques, critical analysis, and debriefing missions will help every person in a boat crew to contribute to developing and implementing a **Risk Management Plan**. A Risk Management Plan identifies and controls risk according to a set of preconceived parameters. Refer to Chapter 4 of this manual for a complete discussion of Risk Assessment and Risk Management Plans.

A.2.b. Situational awareness

NOTE &

Crews who have a high level of SITUATIONAL AWARENESS perform in a safe manner. **Situational Awareness** is an important skill for you to develop as part of learning risk assessment. **Situational Awareness** is the **accurate** perception of factors and conditions affecting the boat crew at any given time during any evolution. More simply, situational awareness is knowing what is going on around you at all times.

Any time you identify an indication that situational awareness is about to be lost, you must make a decision whether or not to continue with the rescue attempt. Everyone in the crew owns some responsibility for making these important decisions. These decisions take the form of action/reaction and communication.

A.2.c. Damage control risk management

The precautions listed below include many of the considerations that can form a basis for a general **Damage Control Risk Management Plan**. Keep in mind that each emergency situation will be unique, therefore the plan must only be used as a **general** guideline. The experience and knowledge of each boat crew should be merged into a Risk Management Plan and used to fine-tune this list.



NOTE &

See District policy on boarding a boat that is on fire.

- Attempt to account for all persons.
- Attempt to have all lines, rigging, etc. removed from the water to avoid fouling your propellers.
- Maintain communications between the coxswain and crew members.
- Have all required equipment tested and ready.
- Approach distressed vessel with your fenders rigged and lines at the ready.
- Approach a vessel on fire from the windward side.
- Remove survivors first, then back off, and evaluate the fire.
- If the risk of explosion is not known (you cannot determine what cargo is on board), back off and do not attempt to fight the fire.
- When necessary, dewater distressed vessel while keeping all equipment aboard your vessel
- Always keep your operational commander or parent unit informed.



Section B. Boat Fire Prevention and Susceptible Areas

Overview

Introduction

Fire is the greatest single potential for disaster on a boat. The possibility of fire can never be completely eliminated and is always a threat to watch for and guard against.

Boat crew members must be especially alert for fire, its possible causes, and areas on a boat that are very susceptible to fire. There are some causes of fire that are more frequently encountered on boats and you must learn to be especially watchful for them.

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Preventive Actions

B.1. Preventive actions

In dealing with fire on your boat, the single most important consideration is prevention. During boat and equipment checks, all systems must be inspected including the fuel, oil system, and wiring. Check for abrasions, cracked wiring, or pinholes in oil and fuel lines. Any discrepancy must be corrected at the time it is discovered. The following are also good fire prevention measures for you to practice:

- Keep oil and grease out of bilges.
- Clean up any spilled fuel or lube oil immediately and properly dispose of it ashore.
- Stow cleaning materials off the boat.
- Keep all areas free of waste material.
- Use proper containers for flammable liquids.
- Be alert for suspicious odors and fumes, and vent all spaces thoroughly before starting engine(s).



Susceptible Areas

B.2. Spontaneous ignition

This source of fire is often overlooked as a cause of fire aboard a boat. Many common materials are subject to this dangerous "chemical reaction." A spontaneous ignition can easily occur aboard a boat when an oil or paint soaked rag is discarded in the corner of a compartment or engine room.

B.2.a. Oxidation

When an area is warm and there is no ventilation, oil on a rag begins to oxidize (to react chemically with the oxygen in the warm air around it). Oxidization is a natural process that produces heat. Heat produced by oxidization causes any remaining oil to oxidize even faster and produce still more heat.

B.2.b. Ventilation

Since heat is not drawn away by ventilation, it builds up around a rag and causes it to get hot enough to burst into flames, after which it can ignite any nearby flammable substance and start a major fire. All of this occurs without any additional or outside source of heat. In this case, fire prevention is a matter of good housekeeping. Cleaning rags and waste should be stored in closed or sealed metal containers and discarded as soon as possible.

B.3. Engine room fires

Engine rooms are particularly vulnerable to electrical, fuel, and oil fires. There are several ways that engine room fires can readily start. Water spraying from ruptured seawater lines can cause severe short-circuiting and arcing in electric motors (alternators), electrical panels, and other exposed electrical equipment. This, in turn, can ignite insulation and nearby combustible materials. Even more serious than leaking seawater lines are ruptured fuel and oil lines near electrical equipment. **All** crew members must constantly monitor these lines for leaks.

B.3.a. Electrical system

The electrical system can short and cause a fire. These fires are typically small and easily controlled with either Carbon Dioxide (CO₂) or dry chemical (PKP) extinguishers.

B.3.b. Fuel line

If fittings leak, fuel can drip onto a hot manifold and ignite. This situation could continue unnoticed for some time, allowing a major fire to develop when a manifold finally gets hot enough to ignite all leaked fuel.



B.3.c. Lube oil line

This line, if leaking or ruptured, will allow lube oil to spill onto a hot engine. As the burning lube oil collects on and around an engine, the engine's fuel supply line would probably be burned through. This would provide a fire with a continuous fuel supply, even after engines have been shut down. As fuel continues to spill into the bilges, spreading fire and blocking access to the engine compartment, a major fire can develop.

B.3.d. Bilge areas

CAUTION!

An explosion is a common accident for boats when bilges are not properly ventilated before starting up. A spark from "turning the key" can instantly ignite the trapped gas creating a potentially deadly explosion.

Fire occurs in bilge areas because of fuel or oil accumulation. Most often, oil or gas leaks into bilges from an undetected break in a fuel or lube oil line. The oil vaporizes, and flammable vapors build up in and around bilge areas. Once these vapors are mixed with air in the right proportions, a spark can ignite them and cause a fire or explosion. Bilge fires can move very quickly around machinery and piping and are not easily controlled. They are more difficult to extinguish than most other types of engine room fires. Bilge areas should be watched closely. Oil in a bilge nearly always indicates a leak and all fuel and lube oil lines should be checked until the leak is found.

B.4. Electrical circuits and equipment

NOTE &

With properly insulated and wired equipment, electricity is a safe and convenient source of power. However, when electrical equipment exceeds its useful life, is misused, or is poorly wired, it can convert electrical energy to heat. Equipment then becomes a source of ignition and a "fire hazard." For this reason, electrical equipment must be installed, maintained, tested, and repaired in strict accordance with published regulations.

All work on electrical equipment and circuits must be completed only by qualified personnel.



B.4.a. Replacement parts and equipment

Standard residential or industrial electrical equipment does not last very long at sea. The salt air causes "corrosion," the boat's vibration breaks down the equipment, and a steel hull can cause erratic operation or a shorted circuit. As a result, equipment or its wiring may overheat or arc, causing a fire when flammable materials are located nearby. For this reason, **only** approved replacement parts and equipment should be installed aboard small boats. Given proper maintenance, these parts and equipment are designed to withstand the strenuous conditions encountered at sea.

B.4.b. Wiring and fuses

Insulation on electrical wiring will not last forever. With age and use, it can become brittle and crack. It may be rubbed (chafed) through or broken by abuse or by the vibration of a boat. Once insulation is broken, bare wires are dangerous. A single exposed wire can arc to any metal object. If both wires are exposed, they can touch each other and cause a short circuit. Either condition could produce enough heat to ignite insulation on wiring or some other flammable material nearby. This type of fire can be prevented by replacing wires that have faulty or worn insulation. Install only fuses and circuit breakers of the proper size for their circuits.

WARNING

When a fuse or circuit breaker in a particular circuit is too large, a circuit will not "break" when overloaded. Instead, increased current will continue, a circuit will overheat, and eventually insulation will burn and may ignite other combustible material in the vicinity.

B.4.c. Temporary and unauthorized repairs and patches

"Jury-rigging" of electrical panels to serve additional equipment is a dangerous practice. Wiring in every electrical circuit is designed to carry a specified maximum load. When circuit wiring is overloaded with too many pieces of operating equipment, it can overheat and burn its insulation. Hot wiring can also ignite flammable materials in surrounding areas.



B.4.d. Electric motors (alternators)

Faulty electric motors are major causes of fire. Problems may result when a motor is not properly maintained or when it exceeds its useful life. A motor requires regular inspection, testing, lubrication, and cleaning. Sparks and arcing can result if a winding becomes short-circuited or grounded or if the brushes do not operate smoothly. If a spark or an arc is strong enough, it can ignite nearby combustible material. Lack of lubrication may cause the motor bearings to overheat, with the same result.

B.4.e. Charging batteries

When batteries are charging, they emit hydrogen, a highly flammable gas that is potentially explosive. Hydrogen is lighter than air and will rise as it is produced. If sufficient ventilation is not available at the highest point above where a battery is being charged, hydrogen will collect at the overhead. Then, any source of ignition will cause an explosion and fire.

CAUTION!

Battery gases are highly explosive. Never smoke around a battery and never disconnect a battery until the surrounding space has been thoroughly ventilated.



Section C. Fire Theory, Classifications, and Fuel Sources

Overview

Introduction

As a boat crew member, you will need to understand the theory of fire, the different classifications of fire, and the types of fuels that perpetuate fires. This knowledge will enable boat crew members to identify the type of precautions, equipment, and extinguishing agents required to successfully fight fires.

In this section

These items are discussed in this section:

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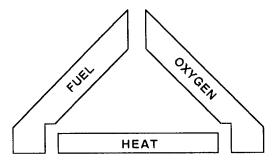
Fire Theory

C.1. General

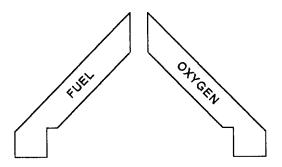
Fire is a chemical reaction known as combustion. It is defined as rapid oxidation of combustible material accompanied by a release of energy in the form of heat and light.

C.2. Fire triangle

For years, a 3-sided figure called the **fire triangle** has been used to describe the combustion and extinguishing theory. This theory states that proper proportions of oxygen, heat, and fuel are required for a fire. If any one of the 3 elements is removed, a fire will cease to exist (See Figure 18-1).



FUEL, OXYGEN AND HEAT ARE NECESSARY FOR COMBUSTION



FIRE CANNOT OCCUR OR EXIST IF ANY PART OF THE FIRE TRIANGLE IS MISSING OR HAS BEEN REMOVED

> Fire Triangle Figure 18-1



C.3. Fire tetrahedron

A new theory has been developed to further explain fire combustion and extinguishment. This theory can be represented by a 4-sided geometric figure, a tetrahedron. The base of this figure represents a chemical reaction. The 3 standing sides of the figure represent heat, oxygen, and fuel. Removing one or more of the 4 sides will make a tetrahedron incomplete and cause a fire to be extinguished (See Figure 18-2).

THE "FIRE TETRAHEDRON", A FOUR-SIDED SOLID WHICH INCLUDES THE CHEMICAL CHAIN REACTION AS ANOTHER COMPONENT NECESSARY FOR BURNING. THESE COMPONENTS THEREFORE FORM A PYRAMID.

OXYGEN SIDE

FUEL SIDE

CHEMICAL CHAIN REACTION

Fire Tetrahedron Figure 18-2



Classification of Fires and Fuel Sources

C.4. Class A	This class of fire involves common combustible materials. Fuel sources within this class include wood and wood-based materials, cloth, paper, rubber, and certain plastics.
C.5. Class B	This class of fire involves flammable or combustible liquids, flammable gases, greases, and similar products. Fuel sources within this class include petroleum products.
C.6. Class C	This class of fire involves energized electrical equipment, conductors, or appliances.
C.7. Class D	This class of fire involves combustible metals. Fuel sources within this class include sodium, potassium, magnesium, and titanium.



Section D. Extinguishing Agents

D.1. General

Extinguishing agents are defined as anything that eliminates one or more "sides" of a fire tetrahedron. When any one is removed, fire can no longer exist.

D.2. How it works

Extinguishing agents put out fires by breaking one or more of the 4 elements of a fire tetrahedron. They work by cooling, smothering, chain breaking, or by a process called oxygen dilution.

- **Cooling** reduces the temperature of a fuel source below the fuel's ignition point.
- **Smothering** separates a fuel source from its oxygen supply.
- Chain Breaking disrupts the chemical process necessary to sustain a fire. The element of a chain that is broken depends upon the class of fire and the type of extinguishing agent used.
- Oxygen Dilution is a smothering process that reduces the amount of oxygen available to a level below that required to sustain combustion.

The different fire classes, the fuel source for each class, the type of extinguishing agent for each class, and the primary effect of each agent are described as follows:



Class	Fuel Sources	Primary	Primary Effect
		Extinguishing Agent	
A	Common combustible materials such as wood and wood based materials, cloth, paper, rubber, and certain plastics.	WaterABC Dry Chemical	Removes the heat element.
В	Involves flammable or combustible liquids, flammable gasses, greases, petroleum products, and similar products.	 Foam AFFF (Aqueous Film Forming Foam) CO₂ PKP (dry chemical) 	Removes the oxygen element.
С	Involves energized electrical equipment, conductors, or appliances.	CO2 (Carbon Dioxide)PKP (dry chemical)	Removes the oxygen element, and temporarily removes elements of oxygen and heat.
D	Involves combustible metals, such as sodium, potassium, magnesium, and titanium.	 Water (high velocity fog) Sand (placed underneath the metal) 	Removes the heat and oxygen elements.



Section E. Applying Extinguishing Agents

Overview

Introduction

Extinguishing agents can be applied in more than one way. Selecting the most appropriate method for applying extinguishing agents depends on the situation. Below are some general guidelines for applying different agents. Later we will address the equipment that must be used to apply these extinguishing agents.

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Applying Water

E.1. Applying water

On board Coast Guard vessels, water for firefighting comes from a builtin fire pump through the fire main and hose system. You apply water to a fire using one of 3 ways:

- Straight (solid) stream
- High-velocity fog
- Low-velocity fog

E.1.a. Straight (solid) stream

A straight solid stream of water is used when long reach and penetrating power are critical. On Class A fires, its primary purpose is to break up burning material and to penetrate the base of a flame. Therefore, you must direct a solid stream at the base of flames in a Class A fire.

A solid stream of water is **not effective for extinguishing Class B fires**. It can cause a violent fire reaction if a water stream atomizes fuel into the air causing an increased surface area.

A straight solid stream can also be used on Class D fires for cooling and to wash burning materials over the side.

A straight solid stream of water should **not** be used on a Class C fire because it is a conductor of electricity and, therefore, could be hazardous to a firefighting team.

E.1.b. High-velocity fog

High-velocity fog is more useful than a solid stream on Class A fires. One reason is that high-velocity fog can cool a much wider surface than a steady stream and consequently, it can absorb more heat. Additionally, as fog comes into contact with any surface heated by fire, it becomes steam. Steam provides a secondary smothering effect which further aids in extinguishing the fire.

Because of the cooling qualities of finely divided water particles, you can use high-velocity fog successfully on Class B fires. You should use high-velocity fog on flammable liquids only when Aqueous Film-Forming Foam (See Section F.2) is not available.



When water is broken into small particles (nozzle fog patterns), there is little danger of it carrying electric current making high- or low-velocity fog safe to use on Class C fires. However, you should operate the nozzles at least 4 feet from a fire source.

NOTE &

Nozzles can pose an electrical shock hazard to firefighters. If a nozzle or solid stream accidentally contacts electrical equipment or circuits, an electrical charge may be conducted back to the nozzle operator and cause injury.

Water is the recommended agent for Class D fires when applied in quantity as fog patterns. When water is applied to burning Class D materials, there may be small explosions. The fire fighter should apply water from a safe distance or from behind suitable shelter.

Class D materials will continue burning until the material is completely consumed but cooling streams of water can control the burn. However, your efforts should be directed at jettisoning or washing the materials over the side to avoid accumulating fire fighting water inside the vessel. Water fog can also be used to protect fire fighters from both convective and radiant heat.

E.1.c. Low-velocity fog

Low-velocity fog is applied with a vari-nozzle. Low-velocity fog is a less powerful pressurized spray than high-velocity fog. Because low-velocity fog covers more area than high-velocity fog, it may be used most effectively when you can get right up next to the fire.

CAUTION!

Low-velocity water fog can also provide a heat shield by forming a screen of water droplets between a fire fighter and the fire. When fire fighters are properly clothed and hose lines have vari-nozzles it is not necessary to use low-velocity water for personnel protection.

Do not wet down the lead attack nozzleman. The combination of moisture and high temperature can cause steam burns.

Fog streams used improperly can injure personnel. The fog screen from high-velocity fog can obscure an attack nozzleman's visibility. This is extremely important to remember when no opening exists in the compartment or passageway other than the opening through which the nozzle is being advanced. In spaces with only one opening, heat and smoke can blow back or burst through or around a fog curtain. When



circumstances require that you enter a compartment or passageway which has only one opening, direct short bursts of solid stream or fog toward the overhead to knock down the flames.

Using water as an extinguishing agent adds water and weight to a vessel. This can cause the vessel to become unstable. Normally, the water will be removed (dewatered) after the fire has been extinguished. However, to maintain stability and decrease the threat to your crew, dewater the vessel as soon as possible.

E.2. Effectiveness

Water can be effective on all classes of fire, when properly applied for the situation. However, it is most effective for Class A fires. It is recommended for use in Class D (combustible metals) fires for its cooling effect and ability to wash the material away.



Applying Aqueous Film-Forming Foam (AFFF)

E.3. Applying Aqueous Film-Forming Foam (AFFF)

Foam is essentially a blanket of bubbles that extinguishes a fire mainly by smothering. The bubbles are formed by mixing water, air, and a foammaking agent called foam concentrate. The mixture of water, air, and foam concentrate becomes foam solution.

When using foam, you must coat the entire surface of a flame or uncovered areas will continue to burn. One gallon of liquid foam solution will produce about 133 gallons of mechanical foam. The contents of one 5-gallon can of liquid foam will last about 1½ minutes and will produce about 660 gallons of mechanical foam.

Foam may be used against Class C fires in an emergency and as a last resort. AFFF concentrate separates at temperatures below 35°F. This does not affect its usefulness provided you shake the can to re-mix components before use.

E.4. Effectiveness

Foam is effective against Class B fires. Foam solution is lighter than the lightest of flammable liquids. When applied to burning liquids, it floats on the surface and prevents oxygen from reaching the fuel source. In addition, the water content of foam provides a cooling effect on the fire.



Applying Chemical Agents

E.5. General

Chemical agents can be very effective firefighting tools. However, they can be ineffective and sometimes dangerous if they are not used properly. You must learn the proper use of each chemical agent, including its advantages and disadvantages, before using it to fight a fire. Two chemical agents are discussed below:

- Carbon Dioxide (CO₂)
- Potassium Bicarbonate (PKP) most likely not found on Auxiliary facilities

E.6. Carbon Dioxide (CO₂)

 CO_2 is a colorless gas about 50 percent heavier than air. When released from its container, the gas expands to 450 times its stored volume and smothers a fire by denying it oxygen. Because it is a nonconductor of electricity, CO_2 is the primary agent used against electrical fires. It can also be used effectively against an engine room fire. Additionally, CO_2 does not have to be cleaned up after use as does foam.

E.6.a. Effectiveness of CO₂

CAUTION!

CO₂ should never be used alone to fight a major fire.

 CO_2 is effective on small class "A," "B," and "C" fires. It has a very limited cooling capacity and does not remove oxygen from a fuel source. Therefore, CO_2 is only effective in knocking down flames. Unless CO_2 is used continuously until all flames are extinguished, the fire could reignite (reflash). In fact, the likelihood of a reflash is greater when CO_2 is used against a fire than any other type of agent.

A continuous discharge of CO_2 from a fully charged 5 lb. Extinguisher will last approximately 10 to 15 seconds. The effective range for the portable CO_2 extinguisher is approximately 5 feet. A distance of more than 5 feet may cause the CO_2 to mix with the air and become ineffective.

E.6.b. Discharging CO₂

 CO_2 gas is not a conductor of electricity. However, when discharging the CO_2 , static electricity may build up in the horn. This could be quite dangerous when extinguishing a fire where explosive gasses are present. CO_2 is most effective in closed spaces away from the effects of strong winds. The following are the operating procedures for the CO_2 extinguisher.



Step	Procedure
1	Remove the locking pin from the valve.
2	Carry the extinguisher in an upright position, approaching the fire
	as close as safety permits.
3	For the 5 lb. size, swing the horn up to a horizontal position.
4	Grasp the insulated horn handle and squeeze the release lever to
	start the extinguisher.
5	Direct the flow of CO ₂ toward the <u>base</u> of the flame and attack
	the flame with a sweeping movement of the nozzle.

WARNING 🖖

 CO_2 is extremely cold when discharged, and can "burn" or raise blisters. Keep hands on the insulated horn handle when using the CO_2 extinguisher.

E.7. Potassium Bicarbonate (PKP)

PKP is also known as Purple K Powder. The ingredients used in PKP are non-toxic. When PKP is applied, a dense cloud is formed in the combustion area which limits the amount of heat that can be radiated back to the heart of the fire. Fewer fuel vapors are produced due to the reduced radiant heat. The dry chemical PKP extinguishes flames by breaking the combustion chain. PKP was developed to be used with AFFF.

E.7.a. Effectiveness of PKP

CAUTION!

PKP, like CO₂, should never be used against a major fire for it presents the same hazard of a reflash as CO₂.

PKP does not have cooling capability. PKP may be effective as a temporary measure for extinguishing a flame, but it dissipates rapidly. Therefore, make certain all hot spots are cooled to prevent re-ignition. It is effective to some degree on all types of fires, but is particularly effective when used against burning liquids. Most extinguishers have an effective range of 10 to 12 feet and will last between 8-20 seconds in continuous use.



E.7.b. Discharging dry chemicals

The dry chemical or powder contained in these portable containers is expelled by either a gas cartridge or by stored-pressure within the container. The following is the procedures for using this type of extinguisher.

Step	Procedure
1	Operate the dry chemical extinguisher by following the
	instructions printed on the extinguisher.
2	Control the discharge of the dry chemical by the nozzle shut-off
	valve for both cartridge-operated and pressurized dry chemical
	extinguishers.
3	Approach the fire as close as safety will allow.
4	Direct the discharge at the <u>base</u> of the flame and attack with a
	sweeping movement.



Applying Halon

E.8 General

Halon, a liquefied compressed gas, is odorless, colorless, and electrically nonconductive. Halon differs from the other extinguishing agents in the way it extinguishes fires. It has some of water's cooling effect and some of CO2's smothering power, but Halon actually reacts chemically with the fire to interrupt the chain reaction that causes fire to spread. This process is known as "chain breaking," which was discussed in Section D of this chapter.

Halon flooding systems are typically used to extinguish fires in machinery spaces where Class C fires occur.

E.9. Storage and safety

CAUTION!

Personnel should not remain in a space where Halon has been released unless an oxygen breathing apparatus (OBA) is worn. All Halon is stored in liquid form in steel storage cylinders. Inside the cylinders, liquid Halon is pressurized using super-pressurized nitrogen. When activated, Halon is expelled as a gas. A Halon flooding system rapidly distributes a 5- to 7-percent concentration evenly throughout any space.

On small boats that have Halon systems, and after a Halon system has been deployed, ventilation in a space where Halon was released must be run on high for a minimum of 15 minutes before personnel re-enter that space without a breathing device. On vessels that have no mechanical ventilation, the space must be thoroughly ventilated using natural ventilation.

E.10. Effectiveness

The mechanism by which Halon extinguishes a fire is not thoroughly understood. Halon acts by removing active chemical spaces involved in a flame chain reaction. Halon complements a total fire fighting system as a final line of defense after other alternatives such as portable extinguishers have been used.



Applying FE-241

E.11. Applying FE-241

Like Halon, FE-241 is a liquefied compressed gas. It is classified as "clean agent", meaning it leaves no residue when used to extinguish fires. Its chemical name is Chlorotetrafluoroethane. Like Halon, it *chemically* interferes with the combustion process for fire extinguishment. However, FE-241 is an environmentally safe U.S. Coast Guard approved and EPA-accepted Halon alternate extinguishing agent. This means that FE-241 can be used in place of Halon to extinguish Class C fires.



Section F. Firefighting Equipment

Overview

Introduction

Specialized equipment is used to apply extinguishing agents. In this section, you will learn the "basics" of how to operate the most common kinds of firefighting equipment found on Coast Guard boats.

In this section

These items are discussed in this section:

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Wye-Gate	18-33
Tri-Gate	18-34
Vari-Nozzle	18-36
Fire Monitor	18-37
In-Line Proportioner	18-39
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Fire Axe	18-44
Carbon Dioxide (CO2) Extinguishers	18-45
Dry Chemical Extinguishers (PKP)	18-47



Fire Hose

F.1. General

Fire hoses are a basic firefighting tool. Although taken for granted, hoses are highly developed tools that must be used and cared for properly.

F.2 Description

A standard fire hose is a double-jacketed, cotton or nylon-impregnated, rubber-lined hose (orange in color). It comes in 2 common diameters: 1½-inch or 2½-inch and is produced in standard lengths of 50 feet. A length of fire hose on Coast Guard boats must be shorter than a standard length because of limited space. The 1½-inch hoses are available in 25 and 50-foot lengths and 2½-inch hoses come in 30-foot lengths.

F.3. Safety precautions

CAUTION!

A charged hose has considerable force and can swing out of control. Before using a fire hose, you must perform several safety checks. These checks may seem needlessly time consuming at a fire scene. Nonetheless, they must be performed to prevent a malfunction in a hose system which could cause you to lose even more time. The following checks should be performed:

- Make certain all hose connections are tight and a hose is free of kinks and twists.
- Ensure the bail on a nozzle is closed before a hose is charged.
- Never lay a hose on an excessively hot deck.
- Be sure there are enough people available to control a fire hose before charging it. Never leave a charged hose unattended.

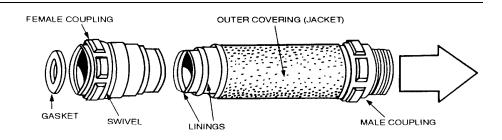
F.4. Operating procedures

A minimum of 2 people are recommended to control a 1½-inch hose.

F.5. Coupling

A fire hose has brass or metal fittings, known as male and female couplings at its ends. This allows one hose to be attached to another or to a fitting. A female coupling connects to a boat's fire main. A male coupling connects to a nozzle or to a female coupling on another length of hose. To connect lengths of fire hose, take half a turn to the left on the female coupling to set the threads. Then turn to the right until the connection is tight. Fittings should be hand tight (See Figure 18-3).





Fire Hose Coupling Figure 18-3

F.6. Maintenance

Remove dirt, grease, abrasives, and other foreign matter from the outer coverings of hoses. Clean fire hoses with a mild soap and water solution (inside and out). Do not use abrasives to clean hoses. After use, hoses must be stowed. To properly stow a fire hose, perform the following:

- Check a hose to make sure it is completely drained.
- Ensure that a proper gasket is in place inside the female coupling and that it is not cracked or damaged.
- Roll hoses so the male coupling is lying between hose layers to prevent damage to a coupling's threads. This also allows the female coupling to be connected, and hose rolled out without twisting.



Spanner Wrench

F.7. General

Spanner wrenches are very important when working with fire hoses. They are necessary to properly couple hoses together, to attach other equipment to hoses, or to attach hoses to water sources.

F.8. Description

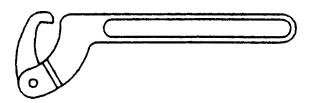
A spanner wrench is adjustable so that is can be used with all standard sizes of fire hoses. A range of adjustment is indicated on the handle of a wrench. A curved tip on the working end of a wrench is made to fit all notches in a coupling.

F.9. Safety precautions

As with using any wrench, be careful not to get fingers or other objects caught between the wrench and the coupling. Ensure the working end of the wrench is in the notch before applying heavy pressure.

F.10. Operating procedures

On properly maintained hoses, connections may be effectively tightened by hand. However, if there is water leakage at a connection, a spanner wrench may be used. Once a wrench is adjusted, just insert the tip of a wrench into the notch and pull the wrench handle to the right (See Figure 18-4).



Spanner Wrench Figure 18-4

F.11. Maintenance

They must be de-rusted and greased or oiled periodically.



Wye-Gate

F.12. General

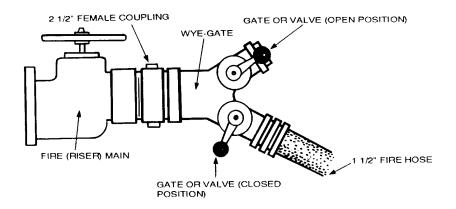
Wye-gates are important firefighting tools. They allow a single stream of fire fighting water to be divided into 2 streams.

F.13. Description

The wye-gate is a Y-shaped fitting used to reduce fire hose line size and allow use of 2 separate hoses. It has one female $2\frac{1}{2}$ -inch inlet opening and two $1\frac{1}{2}$ -inch male outlet openings. A female end attaches to a fire main or between fire hose lengths (the $2\frac{1}{2}$ -inch being reduced to $1\frac{1}{2}$ -inch fire hoses). Male openings receive two $1\frac{1}{2}$ -inch fire hoses.

F.14. Operating procedures

A wye-gate makes it possible to fight fire with 2 hoses. A flow of water through each of the 1½-inch openings may be regulated or secured with the valves or gates. The 2 gates are independent of each other, so one can be closed while the other is open. A gate is opened or closed with a quarter turn. Figure 18-5 shows a wye-gate with one open and one closed gate. Note the gate position for each (see Figure 18-5).



Wye-gate Attached to Fire Main Figure 18-5

F.15. Maintenance

They must be periodically cleaned of corrosion and greased or oiled.



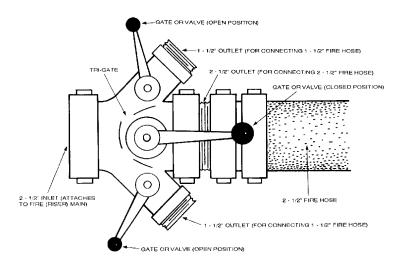
Trigate

F.16. Tri-gate

Tri-gates, like wye-gates, divide a single stream of fire fighting water. However, they divide a single stream into 3 separate streams instead of only 2 streams.

F.17. Description

A tri-gate is another fitting to which fire hoses are frequently connected. A tri-gate has two 2½-inch openings and two 1½-inch openings. A tri-gate, like a wye-gate, is used when you must fight a fire with multiple fire hoses (See Figure 18-6).



Tri-Gate Figure 18-6

F.18. Safety precautions

While both wye-gates and tri-gates allow additional fire hoses to be directed against a fire, their use may result in a large water pressure drop at the nozzle.

F.19. Operating procedures

The gates or valves on a tri-gate control the flow of water in the same fashion as regulating gates on a wye-gate. To use the tri-gate use the following procedures:



Step	Procedure
1	Break out the tri-gate
2	Connect the tri-gate to the firemain.
3	Connect a length of 2½" firehose to the tri-gate.
4	Connect a length of 1½" firehose to the tri-gate.
5	Place the Gate regulating handle of the 2½" and 1½" hose outlets
	of the tri-gate of which the hoses are connect in the "OPEN"
	position.
6	Ensure the regulating gate of the second 1½" outlet is in the
	"CLOSED" position.
7	Charge the firehoses (assisted by other crew members).
8	Check the tri-gate, valves, and hose connections for water leakage;
	tighten with a spanner wrench, if necessary.

F.20. Maintenance

They must be periodically cleaned of corrosion and greased or oiled.



Vari-Nozzle

F.21. General

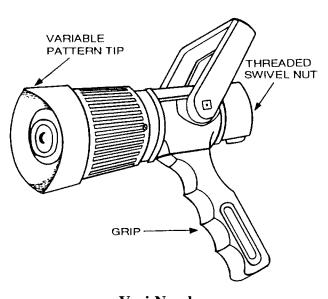
This type of nozzle can be used for fighting all classes of fires and for personnel protection.

F.22. Description

A Navy vari-nozzle is fitted with a pistol grip handle on the underside of the nozzle. A bail handle opens and closes the nozzle. A 90o pattern is achieved at the wide angle setting. A vari-nozzle is a variable stream fog nozzle that is adjustable from straight stream to wide angle fog as well as intermediate patterns between these extremes.

F.23. Operating procedures

This nozzle is used with AFFF for extinguishing Class B fires (See Figure 18-7).



Vari-Nozzle Figure 18-7

F.24. Maintenance

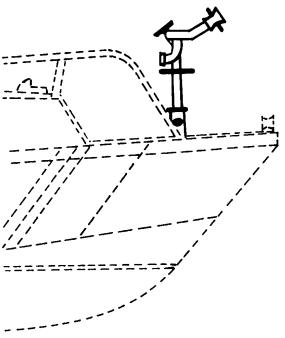
Clean a nozzle with a mild solution of soap and water. Do not use abrasives to clean nozzles. After use, stow the nozzle. You should always stow a vari-nozzle with the bail handle in closed position with the nozzle set to a narrow angle (30° pattern) fog.



Fire Monitor

F.25. General

A fire monitor allows boats to stay away a safe distance while fighting large dock-side or shipboard fires (See Figure 18-8).



Fire Monitor Figure 18-8

F.26. Description

A fire monitor mounts on top of the forward bitt of a Coast Guard 41-foot UTB. It is capable of projecting a solid stream of water over 130 feet to support major firefighting efforts.

Water is provided to the monitor by a fire pump installed on board the vessel. The pump is driven by a power take-off from the starboard main engine. When the fire pump is engaged, use of the starboard engine is limited and this, in turn, may restrict the capability and maneuverability of a vessel.



F.27. Safety precautions

A fire monitor is heavy to lift and awkward to handle. Do not attempt to mount it with a boat operating at more than idle speed or when a boat is rolling heavily, as the fire monitor may fall and seriously injure a crew member or it may be lost overboard.

F.28. Operating procedures

Crew members designated by a coxswain should follow these steps to mount and operate a fire monitor on a 41-foot UTB.

Step	Procedure
1	Remove the forward bitt cover and place a mounting bracket for a
	fire monitor in the hole provided. Turn the mounting bracket until
	it locks into position.
2	Put the fire monitor on a stanchion and tighten the two hand
	screws to secure it into position.
3	Connect a tri-gate to the vessel's fire main.
4	Connect a 30-foot length of 2½-inch fire hose to the tri-gate and
	lead it forward alongside the pilot house.
5	Connect the other end of this 2½-inch hose to the fire monitor and
	tighten all connections with a spanner wrench.
6	Connect a 25-foot length of 1½-inch fire hose to the tri-gate and
	tighten all connections. This additional length of hose will serve as
	a backup hose to assist and protect an operator of a fire monitor.
7	At this point, other members of a boat crew will engage the fire
	pump and bring water pressure up to 100 PSI.
8	A fire monitor operator should now be in position and ready to
	operate the monitor. Other crew members should now assume
	control of the 1½-inch backup hose before continuing.
9	Charge the fire main and open tri-gate valves to charge the
	monitor and a backup hose.
10	Direct the fire monitor's stream at an appropriate area of a fire and
	adjust the water stream by turning a wheel atop the monitor.
11	Turn the control handle on the fire monitor nozzle to adjust a

NOTE &

If a fire monitor has been mounted for some time while a vessel has been underway, vibration may have loosened some connections. Check and retighten mounting stanchion and hose connections before charging hoses with water pressure.

water stream from full fog to straight stream.



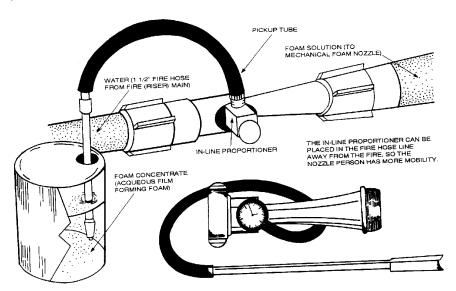
In-Line Proportioner

F.29. General

An in-line proportioner is a device that mixes water and AFFF in proper proportions to create effective foam for firefighting. This is the same function performed by a mechanical foam nozzle. **However, an in-line proportioner may be placed between hoses away from the actual fire** while a mechanical foam nozzle mixes water, air, and AFFF at the nozzle. This difference avoids restricting the mobility of a nozzle operator as does a mechanical foam nozzle.

F.30. Description

Foam is applied by using an in-line proportioner with a mechanical foam nozzle or vari-nozzle. An in-line proportioner is inserted in a fire hose line, between the fire main and a nozzle, and supplies mechanical foam to a nozzle. It may be placed at convenient distances from a fire (See Figure 18-9).



In-Line Proportioner Figure 18-9

F.31. Operating procedures

Procedures for operating an in-line proportioner are described below:



Step	Procedure
1	Attach the proportioner to a fire main.
2	Attach the male end of a fire hose (water supply) to the female end
	of the proportioner.
3	Attach a mechanical foam nozzle or vari-nozzle.
4	Remove the cap from a container of foam concentrate.
5	Insert the metal end of a pickup tube (crows foot) into a container
	of foam concentrate.
6	Staff a fire hose and turn on the water.



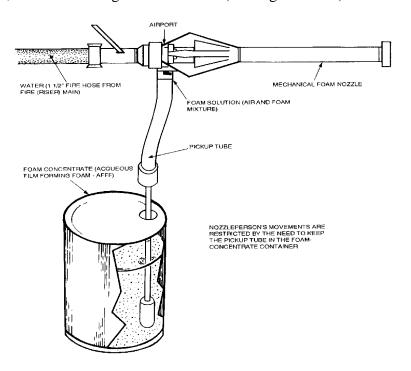
Mechanical Foam Nozzle

F.32. Mechanical foam nozzle

A mechanical foam nozzle is a device that mixes water, air, and AFFF in proper proportions to produce effective fire fighting foam.

F.33. Description

A mechanical foam nozzle is attached to a standard fire hose running from the fire main system. It draws air in through air ports located in the water inlet end of a foam nozzle. When air and foam concentrate mix in a nozzle, foam is discharged toward a fire (See Figure 18-10).



Mechanical Foam Nozzle Figure 18-10

F.34. Safety precautions

A person operating a mechanical foam nozzle must be aware that the range of mobility is limited by the length of the pickup hose leading to a container of foam concentrate. If a nozzle operator moves too far, the pickup tube will lose suction and the nozzle will begin to discharge only water, not foam. Depending on the type of fire being fought, this may be very dangerous.



F.35. Operating procedures

The following steps describe a prescribed operating procedure for a mechanical foam nozzle.

Step	Procedure
1	Remove any other nozzle from the end of a fire hose.
2	Attach a 1½-inch mechanical foam nozzle to the fire hose.
3	Remove the plug from the butt end of the nozzle.
4	Screw the hose end of a pickup tube into the butt end of the
	nozzle.
5	Crew members must now take control of this hose and nozzle
	assembly, then charge it with water pressure.
6	Remove the cap from a container of foam concentrate.
7	Insert the metal end of a pickup tube (a crow's foot) firmly into a
	container of foam concentrate.
8	Direct a stream of foam at the appropriate part of a fire.



Drop Pump and AFFF

F.36. General

Use of a drop pump allows AFFF concentrate to be proportioned with water, adequately agitated, and delivered at a relatively high rate. A drop pump is designed to pump a large volume of water at low pressure.

F.37. Description

A P1 or P5 drop pump is designed to pump a large volume of water at low pressure. The drop pump is not intended for firefighting and therefore is not equipped with fire hose connections.

F.38. Safety precautions

AFFF must be mixed with water. Do not apply it to a fire directly from its container or when it has been mixed with water manually, i.e., without using a mechanical foam nozzle or a drop pump.

There are drawbacks to using a drop pump in place of a mechanical foam nozzle. Once a canister is empty, foam application must be halted so it can be refilled. In addition, the quality and density of foam is not optimum.

F.39. Operating procedures

It is not possible to apply mechanical foam with a drop pump in the conventional way by using an in-line proportioner and/or a mechanical foam nozzle. However, a drop pump can still be used for foam delivery by following the procedure below:

Step	Procedure
1	Break a pump out from its storage container and set it up to take
	suction.
2	Fill the storage container with water using the pump discharge
	hose. It will hold about 38 gallons of water.
3	Pour about 2 gallons of AFFF (about one-third of a standard AFFF
	container) into the pump's storage container.
4	After the storage container is full of water/AFFF mixture, transfer
	the pump's suction hose from over the side to the storage container
	(suction is taken from there). A discharge hose is about 15 feet in
	length. Use it as if it were a mechanical foam nozzle to fight fire in
	a conventional manner. This method allows a high volume of
	foam (AFFF) to be delivered in a short period of time.



Fire Axe

F.40. General

Coast Guard boats are equipped with a type of fire axe referred to as a "pike head axe."

F.41. Description

A pike head axe has a wooden handle securely attached to an axe head. The axe head has 2 different ends. One is a typical broad head blade, well sharpened along the leading edge. The other end of the head, the pike, is pointed and is also well sharpened.

F.42. Safety precautions

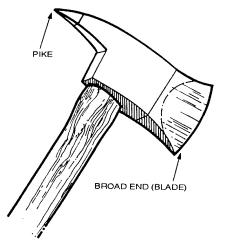
Crew members must always wear gloves, goggles, and other protective clothing when using axes to force a door or break glass.

F.43. Operating procedures

The pike, or pointed end of an axe, is used to break through light metal like that found in metal fire doors, to make quick openings that can be used to check for smoke and intensity of a fire. It may also be used for tearing apart mattresses or for shattering glass. The broad or blade end of an axe can be used to pry doors open, to pry other objects apart, to remove paneling, or to chop doors open.

F.44. Maintenance

Both blade and pike should be kept sharp and oiled. The handle must always be tightly fitted into the head of an axe. It must be free of splits and splinters and should never be painted (See Figure 18-11).



Fire Axe Figure 18-11



Carbon Dioxide (CO₂) Extinguishers

F.45.	Carbon
dioxid	le (CO ₂)
exting	guishers

Portable CO₂ extinguishers are used primarily for putting out electrical fires but they are effective on any small fire including burning oil, gasoline, paint, and trash cans.

F.46. Description

A 10-pound cylinder is the standard CO₂ extinguisher used on Coast Guard small boats. The effective range of this extinguisher is approximately 5 feet from the outer edge of the horn. Once activated, the extinguisher will provide from 40 to 45 seconds of continuous use.

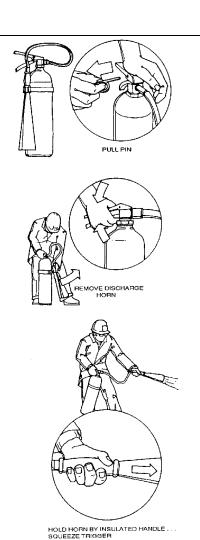
F.47. Safety precautions

When CO₂ is released from a container, it expands rapidly to 450 times its stored volume. This rapid expansion causes the gas temperature to drop to near 110oF below zero and form CO₂ "snow." Do not permit snow to come in contact with your skin because it will cause painful blisters (See Figure 18-12).



WARNING 💖

CO₂ is extremely cold and can burn or raise blisters. Keep your hands on the insulated horn handle when using a cylinder.



Operating the CO₂ Extinguisher Figure 18-12

F.48. Operating procedures

Procedures for using the CO₂ fire extinguisher are as follows:

Step	Procedure
1	Remove a locking pin from the valve.
2	Carry an extinguisher in an upright position and approach a fire
	until you are as close as possible.
3	Grasp the insulated horn handle and squeeze the release lever to
	activate an extinguisher. Keep a cylinder grounded by touching
	it to a deck.
4	Direct a flow of CO ₂ at the base of flames.

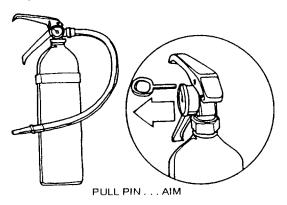


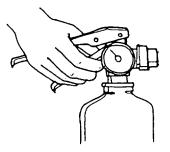
Dry Chemical Extinguishers (PKP)

F.49. Dry chemical extinguishers (PKP) PKP extinguishers are primarily used for Class B fires.

F.50. Description

PKP is nontoxic and is 4 times as effective as CO_2 for extinguishing fuel fires. A PKP extinguisher has an effective range of about 20 feet from the end of its nozzle and will provide from 18 to 20 seconds continuous use (See Figure 14-13).





SQUEEZE TRIGGER

Dry Chemical Extinguisher Figure 18-13



F.51. Safety precautions

PKP is effective on Class C fires, but it should not be used if CO₂ is available. PKP leaves behind a messy residue which can be avoided by using CO₂. Also, long discharges of PKP reduce visibility and may cause breathing difficulties and induce coughing. In confined spaces, PKP should **always** be used sparingly.

PKP is an excellent firefighting agent, but its effects are temporary. It has no cooling effect and provides no protection against reflash of a fire. Therefore, its use should always be immediately followed by an application of foam. A PKP extinguisher **should not** be pressurized until it is to be used.

F.52. Operating procedures

Procedures for using this extinguisher are explained below:

Step	Procedure
1	Check an extinguisher to ensure that its fill cap is tight.
2	Pull a locking pin from the cutter assembly.
3	Stand to one side of the bottle and push down on the puncture
	lever (marked push) to cut a seal on the CO ₂ cartridge.
4	Approach a fire from the windward side and always remain at least
	8 feet away from flames.
5	Discharge the chemical in short bursts by squeezing the nozzle
	grip. Direct chemical at the base of flames and sweep it rapidly
	from side to side. If a fire's heat is intense, a short burst of
	powder into the air will provide a heat shield.



Section G. Firefighting Procedures

Overview

Introduction

In the previous paragraphs you learned how to classify fires and use the classification system to select an appropriate extinguishing agent. You also learned how to use available boat firefighting equipment to apply extinguishing agents. The following paragraphs will explain some safety precautions you must observe when fighting fire as well as some tactical procedures to follow.

In this section

These items are discussed in this section:

Topic	See Page
Coast Guard's Firefighting Duty	18-50
Safety Precautions	18-51
Operations	18-53
Action	18-54



Coast Guard's Firefighting Duty

G.1. General

Boat crew members must always remember that boat crews are **not** firefighting professionals. According to the Coast Guard Firefighting Activities Policy, the boat crews are to support firefighting professionals if necessary. However, if a boat crew were to be first on the scene of a boat fire or be the victims of a boat fire, their primary responsibility is to save **lives**, not property. Evacuate all people from a burning vessel, and then follow a Risk Assessment Plan if capable.

Refer to Section A of this chapter to view the Coast Guard Firefighting Activities Policy, and to Chapter 4 for discussion of a Risk Management Plan.



Safety Precautions

G.2. General

Firefighting can be very hazardous to anyone involved. Coast Guard personnel must always be alert and aware of their actions and decisions to avoid being injured or incapacitated performing firefighting duties that are not their responsibility. Losing the services of any Coast Guard person may keep a boat crew from preventing other injuries, loss of life, or loss of property. Refer to Chapter 4 of this manual for a discussion of risk assessment and risk management.

G.3. Salvors and marine chemists

Shipboard and waterfront fires frequently involve toxic or chemical hazards for firefighters. These hazards may be a source of fire or may be produced as a by-product of fire. Therefore, caution must be exercised and properly trained assistance **requested before becoming involved in fighting a fire.**

Many salvage companies operate over a wide geographic area. Thus, these companies can respond more quickly to these situations. In addition, they employ marine chemists who can obtain temperature readings, check for the presence and concentrations of gases, and can provide information to firefighting forces about chemical hazards they may encounter during response activities.

G.4. Smoke plumes

Coxswains must always stay well clear of smoke plumes rising from a fire because they greatly reduce visibility and can pose a health hazard. Smoke is a visible product of fire and carries water vapor, acids, and other chemicals produced by fire and can be irritating or toxic when inhaled. A smoke plume is made of suspended particles of carbon and other unburned substances. These products of combustion are released into the atmosphere and travel downwind.

G.4.a. Stay upwind

NOTE &

Generally speaking, remaining upwind of the fire provides a safe area away from toxic hazards that are released in a fire plume. As a plume expands downwind and outward from a fire, toxic products will be less concentrated. The more toxic a product is, the larger the unsafe area will be, both downwind and to the sides of a plume. The decision to set a perimeter upwind of a toxic smoke or fire plume must be considered and executed when prudent. Individuals who remain a safe distance upwind should not be affected by unseen dangers of a smoke plume.



G.4.b. Safe distance

Other decisions such as determining a safe distance from a plume of smoke should be made and constantly reevaluated as an incident develops. Any change in weather conditions could dictate a need to increase the initial size of a perimeter. If you can see a smoke plume and feel radiant heat, you are considered to be within a danger zone.

G.4.c. Gases and vapors

Smoke plumes also have other factors that must be considered such as the behavior of gases or vapors that extend beyond a perimeter of visible smoke and fire. Burning plastics and rubber products produce gases, heat, flame, and smoke. These by-products may contain elements of a toxic or lethal nature.

There are many other products of combustion which are dangerous and can be lethal under certain conditions.



Operations

G.5. General

NOTE &

A qualified fire officer is a person who has been trained and certified, under National Fire Protection Association guidelines, to take command of firefighting

A boat crew is faced with several responsibilities and decisions when a vessel or waterfront fire occurs. Decisions made may affect lives, millions of dollars in property, and free flow of maritime commerce. When determining a unit's assistance posture, consider the following:

- Level of the threat of fire
- Jurisdictions involved
- Capabilities of local fire departments
- Availability of Coast Guard equipment
- Level of Coast Guard training

Generally, Coast Guard personnel shall not engage in independent firefighting operations except to save a life or in the early stages of a fire, where they may avert a significant threat without undue risk. Coast Guard personnel shall not engage in firefighting (on other than Coast Guard units) except in support of a regular firefighting organization and under the supervision of a qualified fire officer.

G.6. Personnel training

Coast Guard personnel engaged in firefighting operations must be properly trained and equipped for the task they are assigned. Therefore, the level of Coast Guard involvement is dependent available leadership, experience, training, and equipment.

Coast Guard planning and training efforts must be integrated with those of other responsible agencies, particularly local fire departments and port authorities. This is especially important for fires on large vessels and shore structures. Captains of the Port (COTPs) work closely with municipal fire departments, vessel and facility owners and operators, mutual aid groups, and other interested organizations. COTPs have developed a firefighting contingency plan which addresses firefighting in each port in the COTP zone.



Action

G.7. General

When a Coast Guard boat crew becomes involved in firefighting operations the situation will typically be one that fosters a great sense of urgency to extinguish a fire as rapidly as possible. All members of a boat crew must remember that haste and lack of a coordinated effort by boat crew members can recklessly endanger a boat and all crew members.

G.8. Crew brief

A boat coxswain must brief crew members before arriving at the scene of a fire. This briefing details each crew member's assignments and emphasizes safety. Crew members are responsible for all duties assigned and must request clarification from the coxswain if they do not clearly understand the tasks assigned. Break out all necessary gear. All personnel must don *battle dress* before arriving on scene. *Battle dress* means that everyone will button their collars, wear gloves, don PFDs, and tuck trouser legs into their socks. The coxswain is responsible for inspecting all other crew members and making certain that battle dress has been donned.

G.9. Initial action

Approach the boat from upwind. Immediately upon arriving on scene, all crew members should check the surrounding vicinity for persons in the water. Recover and evacuate all survivors to the Cost Guard vessel. Evaluate their physical conditions and render first aid if necessary. However, if the extent of injury requires more than minor first aid, evacuate survivors to another rescue vessel to immediately transport them for professional medical assistance. Inform operational command or Emergency Medical Service (EMS) of the situation. These steps are to be taken **before** attacking the fire. Remember, **life comes before property**. If there are no survivors or those recovered are in good physical condition and have been evacuated to a safe place, the next step is to stop and evaluate the fire.



G.10. Situation evaluation

As coxswain and crew you must evaluate the following elements of the situation:

WARNING ♥

If you are not certain what the risk of explosion is, back off a safe distance and establish a safety zone. Do not attempt to fight the fire.

Class of fire

Location and extent of a fire

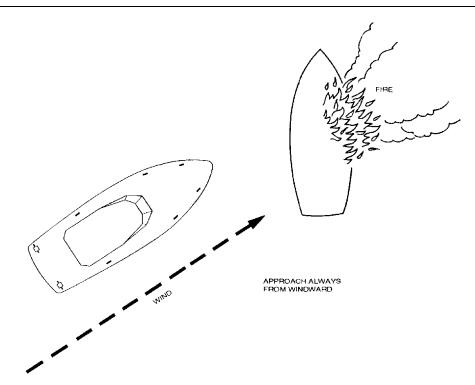
- Class and extent of all cargo involved
- Possibility of explosion
- Possibility of any vessel involved sinking/capsizing within a navigable channel
- Hazard to your crew
- Maneuverability of your vessel
- Weather forecast
- Risk of a serious pollution incident

If a fire can be put out with no danger to your crew or your vessel, proceed. If not, back off and maintain a safety zone so that no other vessel comes too close to the fire scene. After completing your initial evaluation, you need to reevaluate a fire scene/situation frequently. A small fire can rage out of control in minutes and threaten more property and cargo. If you must approach a fire at any time, remember to always approach from windward (See Figure 18-14).

CAUTION!

Your decision regarding your role in the overall situation must be constantly reexamined.





Approaching a Boat on Fire Figure 18-14

If it becomes necessary to tie up alongside a burning vessel to fight a fire or to remove survivors, attach only one line to it and keep a sharp knife accessible for a quick break away.

G.11. Overhauling

Danger will still exist after a fire is believed to be extinguished. The process of overhauling the fire is done to avoid fire reflash. When a fire is out, check for hot spots and set a reflash watch. When danger of reflash is no longer a concern, dewater the distressed vessel.



Section H. Extinguishing Fires

Overview

Introduction

A fire discovered early and quickly fought can usually be extinguished easily. Portable fire extinguishers are used for a fast attack that will knock down flames. However, they contain a limited supply of extinguishing agent. Crew members with limited training in using of these extinguishers often waste extinguishing agent by using them improperly. Periodic training, including practice with actual types of extinguishers carried on board boats, will ensure proficient use of this equipment. Extinguishers that are due to be discharged and inspected should be used for training.

In this section

These items are discussed in this section:

Topic	See Page
Safety Rules	18-58
Fire Combat	18-59
Firefighting Procedures on Coast Guard Boats	18-60
Firefighting Procedures on Auxiliary Boats	18-63
Fires Aboard Other Boats	18-65
Fire Under Control	18-66
Fire Extinguished	18-67
Abandoning A Boat	18-68



Safety Rules

H.1. General

The following safety rules should be observed when using portable fire extinguishers:

- **Immediately** upon discovering a fire, sound an alarm and summon help.
- Never pass a fire to get to an extinguisher.
- If you must enter a compartment to combat a fire, keep an escape path open. Never let a fire get between you and a door, hatch, or scuttle. Stay low.
- If you enter a compartment and fail to extinguish a fire with a portable fire extinguisher, **get out**. Then close the door, hatch, or scuttle to confine the fire.



Fire Combat

H.2. General

An attack should be started immediately to gain control and to prevent extension of a fire to other areas of a boat. An attack will be either **direct** or **indirect**, depending on the fire situation. Both methods are efficient when properly employed.

H3. Direct attack

In a direct attack, crew members advance to the immediate area of a fire and apply extinguishing agent directly on a fire, if a fire is small and has not gained headway. Once a fire has gained headway, an indirect attack should be used.

H.4. Indirect attack

An indirect attack is best when it is impossible for crew members to reach a fire. Generally, this is in the lower portions of a boat, such as the engine room and bilge areas. The success of an indirect attack depends on completely containing a fire. Every possible avenue a fire may travel must be cut off by closing doors, hatches, and scuttles and by securing all ventilation systems.



Firefighting Procedures on Coast Guard Boats

H.5. Procedures

Every fire will quickly spread to new sources of fuel or oxygen if they are available. However, the path through which a particular fire extends will depend on the location of a fire and the construction of surrounding spaces. These factors must be considered when fighting a fire. In addition, fuel and all products of its combustion will affect fire fighting operations. For these reasons, no fire can be fought routinely, and all fires must be fought systematically. The procedures described below should be part of every firefighting operation.

CAUTION!

Never fight a fire, however small it may seem, until an alarm has been sounded. Once a fire gains intensity, it spreads swiftly.

- Cu	D 1
Step	Procedure
1	Sound an alarm. Any crew member who discovers a fire or any
	indication of fire must sound an alarm and give a location, e.g.,
	"FIRE, FIRE, FIRE IN THE BILGES."
2	Evaluate a fire.
	• Determine the air supply to the fire
	• Determine the class of fire (combustible material).
	• Determine the fuel source to the fire
	 Select proper extinguishing agent.
	• Determine method for fighting a fire (direct or indirect).
	 Determine how to prevent spread of a fire.
	• Determine required equipment and crew member assignments.
3	Determine the need to secure:
	• Electrical and electronic power panels.
	Power to individual electrical and electronic equipment
	(alternator, radar, inverters).
	• Engine and fuel supply.
	• Air intakes (ventilation system, doors, hatches and scuttles).



	Step	Procedure
	4	Place all equipment necessary to combat a fire in an open deck
		area. This includes:
		Portable fire extinguishers
		Fire axe
		Fire hoses
		AFFF
		Drop pump
		First Aid kit
_	5	Combat a fire with appropriate extinguishing agent(s).
	6	Notify your parent unit at the earliest opportunity. Keep them
ı		fully advised of your situation.
ı		Give position
ı		Nature of fire
ı		Number of persons on board
ı		Your intentions
ı		• Keep them advised of changing situation and status of
ı		personnel
ı	7	Overhaul a fire.
ı		• Inspect all overhead spaces, decks, and bulkheads.
		• Check where wiring and piping penetrate through bulkheads and decks.
		• Expose areas that are charred, blistered, or discolored by heat
		until a clean area is found.
		Pull apart and examine any materials that might have been
		involved with the fire for hidden fire and hot embers. Jettison
		(throw overboard) all such material if necessary.
		• Set a reflash watch. One crew member must be assigned to do
		nothing but check for re-ignition and to sound an alarm if it

CAUTION!

Water can impair the stability of a boat. Make every effort to limit accumulation of water in compartments. Give preference to fog sprays over solid streams of water. Use only as much water as is absolutely necessary.

occurs.



Step	Procedure
8	Restow all firefighting equipment.
	 Recharge or replace portable fire extinguishers, even if only partially used, immediately upon arrival back at your unit. Replace used fire hoses with dry hoses. Drain, clean, dry, and roll up used hoses for storage.
9	Conduct a damage control check. Start any necessary dewatering
	operations.



Firefighting Procedures on Auxiliary Boats

H.6. Procedures

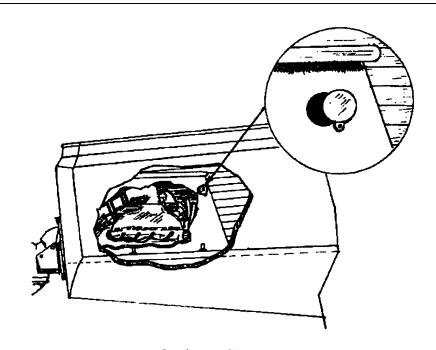
Use the following procedures when battling a fire on an Auxiliary boat. When a crew member becomes aware of an engine compartment fire:

Step	Procedure	
1	Shut off all engines, generators, and ventilation systems.	
2	If boat is equipped with an automatic extinguishing system, ensure	
	it is discharging. If the system is manually operated, energize it and	
	check to ensure it is discharging.	
3	Initiate a MAYDAY call to alert boats in the area of the situation.	
4	Have all crew members don PFDs and everyone move to a smoke-	
	free and flame-free area of the boat.	
5	If a life raft or dinghy is available, put it over the side and inflate it,	
	if necessary.	
6	• If boat has a built-in CO ₂ system, after fire is out, allow time	
	for concentrations of CO ₂ to ventilate to the atmosphere before	
	entering the compartment.	
	On boats fitted with a Halon system, the danger of toxic gases	
	is not as great when entering the compartment, but always	
	enter with caution.	

H.7. Opening a hatch

If someone must open a hatch to discharge a portable extinguisher, expect the possibility of burned hands and/or a singed face. As the fresh air enters the compartment, it will feed the fire, and cause it to "blow up." The best method of opening a hatch is to stand to the hinged side of the hatch. Then while wearing gloves or using something other than bare hands, pull the hatch open. If the boat has a closed engine compartment and no fixed system, it is a good idea to make a small hole with a pivoted cover into the space. A portable extinguisher may be discharged through this hole. (See figure 18-15.)





Hole for Extinguishing the Engine Compartment Figure 8-15



Fires Aboard Other Boats

H.8. Procedures

Use the following procedures when battling a fire aboard other boats.

Step	Procedure
1	Brief crew members on appropriate procedures.
2	Assign each crew member specific duties.
3	While en route to the scene, establish communications with the distressed boat.
4	Approach the boat from upwind. Do not tie any lines to the distressed boat.
5	If no one onboard, circle the boat (at a safe distance) searching for person in the water.
6	Advise all persons aboard the boat to move to a flame and smoke-free area, topside.
7	Attempt to determine the extent and source of the fire. If it is not obvious, ask the personnel aboard the distressed boat where the fire is located.
8	If the fire is beyond the crew members fire fighting capabilities, evacuate the persons from the distressed boat and call for assistance.
9	If the fire is small and within the crew members capabilities, transfer the victims to the rescue boat.
10	Fight the fire in the same manner as a fire on an Auxiliary boat.



Fire Under Control

H.9. General

Under the following circumstances, you may consider a fire to be under control.

- Extinguishing agent is being applied to a fire and has effectively begun to cool it down.
- The main body of a fire (base) has been darkened. At this point, a fire cannot generate enough heat to involve nearby combustible materials.
- All possible routes of fire extension have been examined and found safe or protected (surrounding



Fire Extinguished

H.10. General

Before a fire can be declared completely out, a coxswain must ensure the following actions have taken place.

- A thorough examination of the immediate fire area has been conducted.
- A complete overhaul of all burned material has been accomplished.
- A reflash watch has been set.
- All firefighting equipment has been restowed.
- A damage control check has been performed.
- All crew members have been accounted for.



Abandoning A Boat

H.11. Abandoning a boat

Do not panic and hastily abandon a boat even when a fire is severe. Vigorous and proficient firefighting is normally a preferred alternative to abandoning a boat. However, do not hesitate to abandon the boat if you are becoming trapped by the flames, if you no longer have the equipment to fight the fire, if an explosion is likely (flames by the fuel tanks), or if similar life threatening situations are apparent. If able, inform OPCON of location and any other pertinent information. Make sure that:

- Distress call has been initiated
- All personnel are wearing life jackets
- Put over life raft or dinghy, if available
- Take portable radio
- Take extra signaling gear



Section I. Dewatering

Overview

Introduction

Dewatering a vessel is a consideration that is normally secondary to getting a fire put out. That is not to say, however, that dewatering is not important. Indeed, you may be able to use dewatering equipment to keep the boat from capsizing. You must not only know what equipment is available for dewatering, but how to use it.

In this section

These items are discussed in this section:

Topic	See Page
Action Before Dewatering	18-70
Dewatering With An Eductor	18-71
Dewatering Using A Drop Pump	18-73



Action Before Dewatering

I.1. General

NOTE &

Swimmers will not dive under or enter a capsized vessel. For more information refer to the *National Search and Rescue Manual Addendum*, chapters 4.I and 6.C.

Action taken before beginning to dewater a disabled vessel varies depending upon the nature of flooding. Regardless, a coxswain should always brief crew members on what procedures to follow while emphasizing safety. If crew members have just put out a fire on a boat, someone must then board the vessel and check for flooding, but only when safety permits. A coxswain will direct crew members how to safely accomplish this inspection for flooding.

When responding to a distress call of a disabled vessel taking on water, your initial action on the scene will be to search the immediate area for people in the water. After all survivors are recovered and all persons on board the sinking craft are accounted for and have been evacuated to a safe place, check the sinking craft for hull damage or other sources of flooding. Once a source of flooding is determined, crew members may take steps to reduce water flow into the boat. **Safety of the crew is the first priority**. The distressed vessel should not be boarded if it seems unstable and could possibly capsize. Once onboard, the crew members should wear PFDs and not go below decks if there is any threat of capsizing or sinking. When flooding has been controlled, or at least reduced to a minimum, dewatering can begin. How you dewater a vessel depends on the conditions that exist at the scene.

NOTE &

This manual does not cover technical information and use of commercial gasoline powered pumps, high capacity, manual, or electrical bailing pumps. See and follow the manufacturing instructions for usage while dewatering.



Dewatering with an Eductor

I.2. General

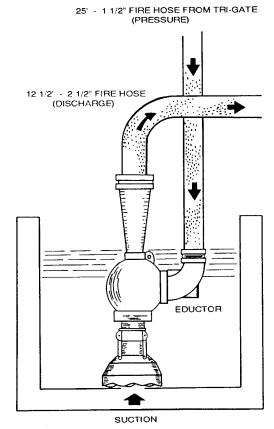
Dewatering with an eductor can be performed only when weather conditions permit your boat to safely come alongside a disabled vessel and remain close to it.

An eductor is used in conjunction with the fire pump on your boat. A 1½-inch fire hose attached to one of the 1½-inch outlets of the fire main is connected to the pressure supply inlet of the eductor. A 2½-inch fire hose is connected to the discharge outlet. The eductor itself is submerged, either vertically or horizontally, in the flooded area to be dewatered. Suction is obtained in either position because of uneven edges of the suction end of an eductor. All eductors operate in fundamentally the same manner. Water from a boat's fire pump is forced through a fire main and out through the discharge hose. As pressure of this rapidly moving water passes over the suction opening, it creates a vacuum. The vacuum, or suction, pulls water up through a suction hose, out through the discharge hose, and over the side of your boat. You must always make certain that a discharge hose leads over the side and a suction hose is placed in flooded areas of a disabled boat. If you inadvertently reverse them, you will quickly fill a disabled vessel with water pumped aboard through the discharge line instead of dewatering it with a suction line (See Figure 18-16).



CAUTION!

Make certain there are no kinks or obstructions in a discharge line.
Their presence will cause an eductor to pump water into a flooded boat through the suction line



Aluminum Eductor Rigged for Dewatering Figure 18-16



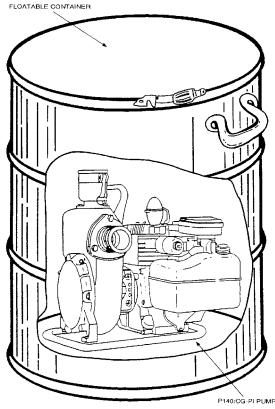
Dewatering Using a Drop Pump

I.3. General

Most Coast Guard boats carry a portable, gasoline-powered drop pump (See Figure 18-17). Dewatering with a drop pump is done with the pump placed on the disabled boat. A drop pump can pump 150 gallons of water per minute (GPM).

WARNING 💖

Do not use a drop pump to dewater a boat with fuel contamination in its bilges.



CG-P1 or CG-P5 Drop Pump Figure 18-17

I.4. Passing a drop pump

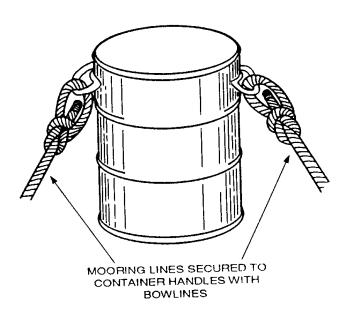
When secured in its watertight container, a drop pump can be easily passed from one boat to another. There are two methods for passing a pump.



I.4.a. Directly passing a drop pump

You should use the following procedures to directly pass a drop pump.

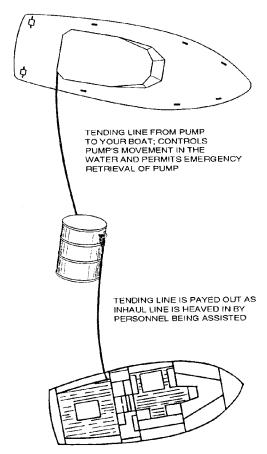
Step	Procedure
1	Determine your rate of drift.
2	Secure a 2-inch mooring line to a bridle attached to a pump
	container or pump container handles (See Figure 18-18).



Securing Lines to Drop Pump Container Figure 18-18

3	Secure a heaving line to the 2-inch mooring line.
4	Rig a tending line from the pump to your boat to enable you to
	control the pump's movement once it is in the water and to haul it
	back in the event of an emergency (See Figure 18-19).





Directly Passing a Drop Pump Using Tending Lines Figure 18-19

Step	Procedure
5	Cast the heaving line, and direct people aboard the disabled boat
	to haul it in.
6	Lower the drop pump overboard and direct people aboard the
	Lower the drop pump overboard and direct people aboard the disabled boat to haul in on the line. Pay out the tending end of the
	line as it is being hauled in.

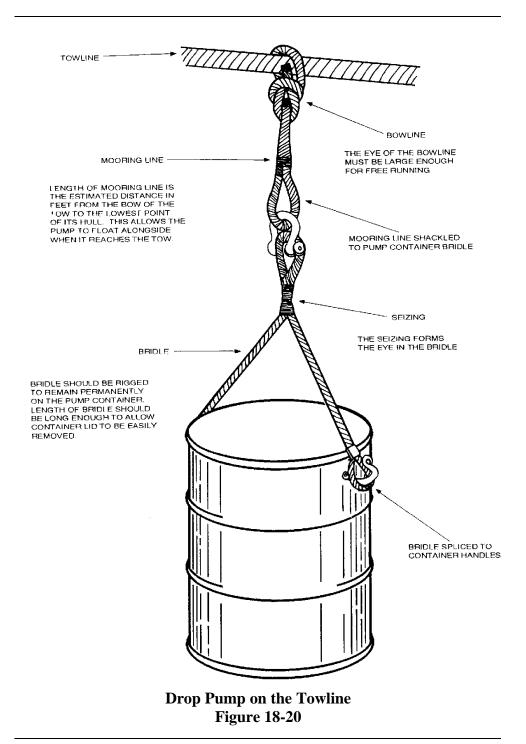
I.4.b. Passing a drop pump into a boat in tow

You should use the following procedure for passing a drop pump to a boat in tow astern.



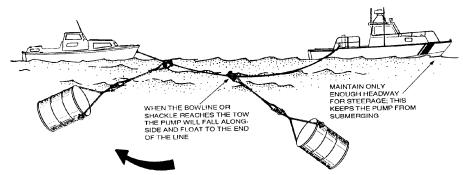
Step	Procedure
1	Rig a bridle to both handles of a pump storage bracket, if a
	permanent bridle has not already been attached.
2	Estimate the distance from the bow of the vessel back to the
	lowest point along the side of its hull. Make up a length of
	mooring line approximately equal to this distance. Secure the
	mooring line to the bridle rigged in Step 1, with a shackle.
3	Make a bowline in the other end of the mooring line, around the
	tow line, so that the tow line passes through the eye of the
	bowline. A shackle may be substituted for a bowline. Regardless
	of the device used, bowline or shackle, the opening must be large
	enough for the mooring line to run freely down the tow line (See
	Figure 18-20).







Step	Procedure
4	Lower the pump over the side and allow it to float back to the
	boat in tow (See Figure 18-21).



Passing a Drop Pump on the Towline Figure 18-21

	Maintain only enough headway for steerage to keep the pump
	from submerging.
6	Instruct the vessel in tow to turn their rudder so as to head into the
	wind or current. This allows the pump to drift away from the
	towed vessel's bow and down its side unobstructed.

I.5. Coming alongside a disabled boat

The procedure described above for directly passing a pump assumes that you cannot come alongside a disabled boat. If you can come alongside, the procedure is much simpler. All you need to do is pass the pump by hand from your boat across to the other boat. At least two people are always required to move a pump, because it is heavy and awkward to carry.

I.6. Pump operation

Follow the procedures below to operate a drop pump.

Step	Procedure
1	Pull the handle to release a tension ring on the storage container.
2	Lift the lid and open the plastic bag. Lift out the drop pump,
	hoses, and fuel.
3	Check the engine oil level. (Oil must be visible.)
4	Check the fuel tank and connection to the engine. Fill if needed.
	(Do not add oil to the fuel.)



Step	Procedure
5	Mount and connect fuel tank (P-1) only.
6	Connect a discharge hose and lay it out on deck so there are no
	kinks or twists. (Discharge hose must be manned or secured by
	tying off.)
7	Place the discharge valve on the pump in the closed position.
8	Place suction hose and strainer in water.
9	Actuate the hand priming pump. Grasp the handle, then raise and
	lower it until the pump is primed.
10	Place the choke lever on the engine in the "choke" position.
11	Pull the recoil starter.
12	Place the engine choke lever in the "run" position. Pull the recoil
	starter again.
13	After the engine starts, prime the pump again A pump can run
	dry for up to one minute, but it was designed to be started only
	after suction has been taken.
14	Open the discharge valve slowly.
15	Post a watch on the pump. The engine will run approximately 2-3
	hours on one tank of fuel, depending on conditions. A Pump
	Watch must be alert for debris around the strainer and must ensure
	the strainer remains submerged. Watch for fuel leaks.
16	Stop a pump and check the engine oil level after 5 hours of
	operation.

NOTE &

If the pull cord on the recoil starter breaks, remove the thumb screws and start it manually using the extra pull cord supplied. For manual starting, wrap the pull cord clockwise around the starter pulley. Grasp the pump handle to secure it and pull the cord.

CAUTION!

Breathing exhaust fumes can be dangerous. Do not attempt to start or operate a pump while it is in a container. Once a pump is started, ensure sufficient ventilation is present to allow exhaust gasses to dissipate into the atmosphere.



I.7. Securing a pump

There are separate procedures for securing a drop pump depending on whether it is being secured because of an emergency or to be stowed.

I.7.a. Emergency

Push the stop lever against the spark plug. This allows a pump to stop for refueling, checking the oil, or standby.

I.7.b. Securing for storage

Follow the procedures below when securing the pump for storage.

Step	Procedure
1	Disconnect the fuel line. The pump will run for approximately one
	minute and stop.
2	Remove the suction and discharge hose.
3	Drain both hoses and any water in the pump.
4	Flush pump and hoses with fresh water.
5	Place in a dry, protected area for drying.
6	After drying, restow all gear in a container.



Section J. Righting Powerboats and Sailboats

Overview

Introduction

Any attempt you make to right a capsized vessel must be carefully thought through before beginning. You must make absolutely certain that all crew members from a distressed vessel are accounted for before beginning any procedure to right the vessel. Survivors may be trapped inside the overturned hull.

When an inboard boat capsizes, dewatering cannot begin until the craft has been righted. There are several methods for righting vessels of this type. You will have to select the best one after evaluating the conditions on scene. Regardless of the method used, always get an accurate count of the persons aboard the capsized boat. Give them PFDs if necessary, and bring them aboard your boat before beginning the righting operation. Approach a disabled craft cautiously, watching for debris that may damage your boat or foul its propellers.

In this section

These items are discussed in this section:

Topic	See Page
Righting Powerboats	18-82
Righting Small Saiboats	18-89
Righting Large Sailboats	18-90



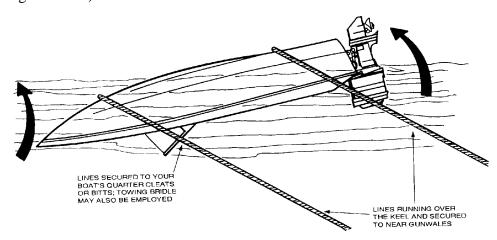
Righting Powerboats

J.1. General

The means you select for attaching lines determines the method of righting. Procedures for each method are outlined below.

J.2. Righting boats by parbuckling

Follow these procedures when righting power boats by parbuckling (see Figure 18-22).



Righting Power Boats By Parbuckling Figure 18-22

Step	Procedure
1	Approach a capsized boat cautiously. Keep clear of all lines and
	debris in the water.
2	Account for all personnel from the capsized boat.
3	Recover all personnel from the water and provide PFDs to them
	as necessary.
4	Select a crew member to enter the water to prepare the boat for
	righting.
5	Direct a crew member to secure your towing bridle or mooring
	lines to the nearest gunwale of the capsized boat.
6	Then a person in the water leads bridle lines or mooring lines over
	the keel and down under the boat. Ensure that these lines are
	outboard of all handrails, lifelines, and stanchions. Then run the
	bridle back to your tow line, or run the mooring lines to your
	boat's rear quarter cleats or bitts.



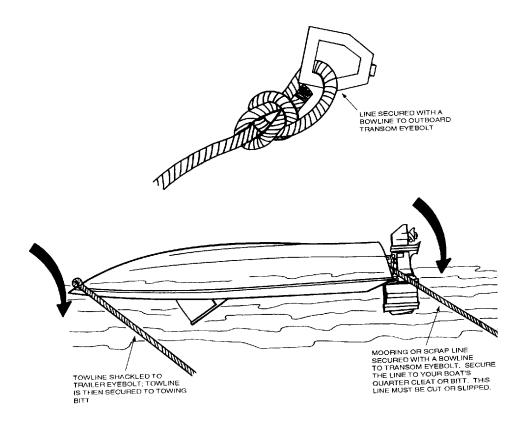
Step	Procedure
7	Recover the tethered swimmer from the water.
8	Pay out enough tow line to prevent the boat from hitting your stern during righting and towing. Then, secure the tow line.
9	Gradually add power to your boat and increase speed. The boat
	should right itself.
10	Bring the righted boat alongside your boat and dewater using the
	most appropriate method.
11	Take in tow astern or alongside.

J.3. Righting using bow and transom eyebolt

Righting Using Bow and Transom Eyebolt. Follow procedures below for righting a vessel using the bow and transom eyebolt.

Step	Procedure
1	Approach a capsized boat cautiouslyfrom downwind, down
	current, or bothkeeping clear of all lines and debris in the water.
2	Account for all personnel from the capsized boat.
3	Recover all personnel from the water and provide them PFDs as
	necessary.
4	Bring the capsized boat alongside the working area of your boat.
5	Use a shackle to secure your tow line to the trailer eyebolt of the
	capsized boat.
6	Secure a piece of mooring line to the capsized boat's outboard
	transom eyebolt (See Figure 18-23).





Righting Capsized Boats Using Bow and Transom Eyebolts Figure 18-23

Step	Procedure
7	Pay out both a tow line and a scrap/mooring line and walk the
	capsized boat to a position astern of and athwartships to (from
	side to side) your boat.
8	Secure the scrap/mooring line to your boat's rear quarter cleat or
	bitt.
9	Pay out enough tow line to permit the boat to remain clear of your
	stern when righting and towing commences. Secure the towline.
10	Gradually add power to your boat and increase speed. When the
	righting motion begins, cut or slip the scrap/mooring line. The
	boat should right itself. Tow the righted boat until you observe
	water being forced over the transom of the disabled boat.
11	When water ceases to flow over the towed boat's transom, reduce
	speed gradually, ensuring that enough water has been forced out
	of the boat during towing to allow it to float on its own.



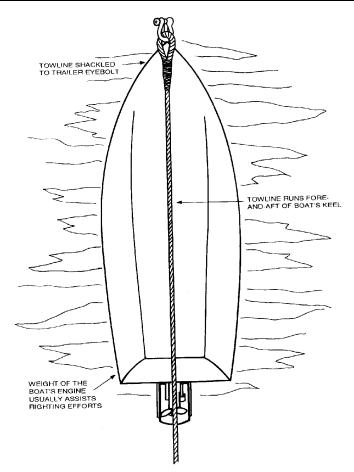
12	Bring the righted boat alongside your boat and dewater it using the most appropriate method.
13	Take in tow astern or alongside.

J.4. Righting using towline fore and aft of boat's keel

Follow the procedures below for righting a boat using a towline fore and aft of the boat's keel:

Step	Procedure
1	Approach the capsized boat cautiouslyfrom downwind, down
	current, or bothkeeping clear of all lines and debris in the water.
2	Account for all personnel from the capsized boat.
3	Recover all personnel from the water and provide PFDs to them
	as necessary.
4	If the operator is willing, one person wearing a PFD may be left in
	the water to assist in righting the boat.
5	If no one aboard the boat is able to assist, direct a crew member to
	enter the water to prepare the boat for righting.
6	Direct the person in the water or a crew member to run your
	towline fore and aft alongside the capsized boat's keel.
7	The person in the water will then secure your towline to the
	capsized boat's trailer eyebolt with a shackle.
8	Ensure the disabled boat is positioned fore and aft, directly astern
	of your boat (capsized boat's stern toward your boat's stern), and
	that the towline is running fore and aft along the capsized vessel's
	keel (See Figure 18-24).





Righting Capsized Boats Using Towline Fore and Aft of Boat's Keel Figure 18-24

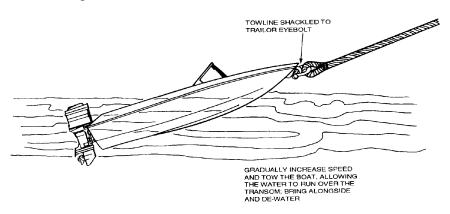
Step	Procedure
10	Pay out enough slack in the towline to permit the boat to clear
	your stern when righting commences. Secure the towline.
11	Gradually add power to your boat and increase speed, pulling on
	the bow of the capsized boat. This pull will be countered by the
	aft portion of the disabled boat, which is the heaviest part of the
	craft. As a result of these two forces, the boat will be righted.
12	Tow the righted boat until you observe water being forced over
	the transom of the disabled boat.
13	When water ceases to flow over the towed boat's transom, reduce
	speed gradually, ensuring that enough water has been forced out
	of the boat during the towing to allow it to float on its own.



Step	Procedure
14	Bring the righted boat alongside your boat and dewater it using
	the most appropriate method.
15	Take in tow astern or alongside.

J.5. Refloating swamped boats astern using trailer eyebolt

This procedure is used for righting a boat that has been swamped from astern (See Figure 18-25).



Refloating Boats Swamped Astern Using Trailer Eyebolt Figure 18-25

Step	Procedure
1	Approach a swamped boat cautiouslyfrom downwind, down
	current, or bothkeeping clear of all lines and debris in the water.
2	Account for all personnel from the swamped boat.
3	Recover all personnel from the water and provide them PFDs if
	necessary.
4	Bring the swamped boat alongside the working area of your boat.
5	Secure your tow line to the trailer eyebolt of the swamped boat
	with a shackle.
6	Pay out your tow line and walk the swamped boat directly astern
	of your boat.
7	Pay out enough tow line to permit the swamped boat to remain
	clear of your stern when towing commences. Secure the towline.
8	Gradually add power to your boat and increase speed taking the
	swamped boat in tow. Tow the boat until you observe water
	being forced over the transom of the disabled boat.



Step	Procedure
9	When water ceases to flow over the towed boat's transom, reduce
	speed gradually, ensuring that enough water has been forced out
	of the boat during towing to allow it to float on its own.
10	Bring the boat alongside your boat and dewater it using the most
	appropriate method.
11	Take in tow astern or alongside.



Righting Small Sailboats

J.6. General

Approach the capsized sailboat from upwind, up current, or both, remaining clear of lines and debris. Account for all personnel from the sailboat and recover them as necessary. At least one person will be needed in the water from the capsized boat, to help in righting the boat. Do not attempt righting if the weather presents a hazard to the rescue boat or personnel.

J.7. Procedures

The following are procedures for righting a small sailboat.

NOTE &

Sails still hoisted create severe drage and force against righting attempts. They may even cause the boat to capsize again once it is successfully righted.

Step	Procedure
1	The person in the water unships or removes the sails.
2	The sails, if removed, should be put aboard the rescue boat or
	secured to the disabled boat.
3	The person in the water then stands on the keel or centerboard
	and leans back while holding on the gunwale. The boat should
	slowly begin to come back over.
4	Once the sailboat is righted, recover the swimmer and begin
	dewatering.



Righting Large Sailboats

J.8. General

A procedure called parbuckling may be used to right capsized powerboats or sailboats over 25 feet in length. Also, parbuckling should be used for righting small sailboats that cannot be righted by the method previously described.

J.9. Procedure

A person from the overturned boat or a crew member from the rescue boat must enter the water to prepare the boat for righting. The following is the procedure for righting a sailboat using parbuckling.

CAUTION

If the weather prevents a danger to the person in the water or the boats involved, do not attempt righting.

J.10. Procedures

The following are procedures for righting a small sailboat.

WARNING 💖

Do not secure any lines to the masts of sailboats. The force exerted during the righting may cause them to fracture.

Step	Procedure
1	Unship or remove the sails.
2	Have the person in the water run a bridle or towline to the capsized boat.
3	Ensure that the lines rigged for righting, are outboard of all stays, shrouds, lifelines and stanchions.
4	Secure lines to available deck fittings.
5	Connect the other end of the bridle to the towline. Pay out enough line to prevent the distressed boat's mast (if so equipped) from striking the rescue boat should the distressed boat continue to roll in that direction.
6	Recover the person in the water
7	Commence righting by going ahead slowly on the engines.
8	Once a sailboat is righted, crew members should board it from the stern (because of the boat's instability) and secure all loose lines.
9	Secure the boom to stop it from swinging and possibly capsizing the boat again.
10	Begin dewatering.



Section K. Flood Control

Overview

Introduction

Boats sometimes become damaged in groundings, collisions, or from striking submerged objects. These mishaps may result in a holed, cracked, or weakened hull. If the hull has been damaged to the extent that water is entering the interior of the boat, it must be plugged or patched to keep the boat afloat.

NOTE &

The primary purpose of Coast Guard SAR is to save lives at sea. Conducting damage (flooding) control operations to save property alone should only be done after a complete re-assessment of the situation has been done to ensure the crew will not be subjected to undue risk.

In this section

These items are discussed in this section:

Topic	See Page
Plugging Holes	18-92
Patching Holes	18-94
Patching Cracks	18-97



Plugging Holes

K.1. Plugs

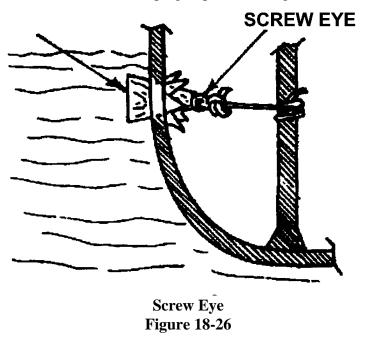
The simplest method of stopping a small hole in wooden or metal hulls is to insert a plug or plugs. Plugs are usually made of a soft wood such as pine or fir. Use plugs individually if they fit the hole, or use them in combination with other materials, to make a better fit.

K.2. Prepare plug

Wrapping cloth around each plug before insert in them in the hole will help to keep the plug in place. It also fills the gaps between plugs.

K.3. Inserting plugs

When plugging holes, it is usually easiest to insert the plugs from the inside. However, sometimes the rough edges protruding inward may make this method impossible. If it is necessary to insert the plugs from the outside, the inboard end(s) of the plug(s) should be fitted with screw eyes. Attach a line to each screw eye and fasten the line to a structure inside the boat. It will hold the plug in place (See figure 18-26).



K.4. Large holes

Large holes are generally too difficult to plug. Use a patch to reduce the flow of water through a large hole, if an attempt is made.



K.5. Fiberglass hulls

Fiberglass may the most difficult of all hull materials to plug. Wooden conical plugs driven into the hole may do nothing more than cause further splitting and cracking and add to an already difficult situation. The best method of plugging a hole in fiberglass is to shove some pliable type of material into it such as a rag, shirt, or piece of canvas. A PFD or a blanket may also work well.



Patching Holes

K.6. Holes below the waterline

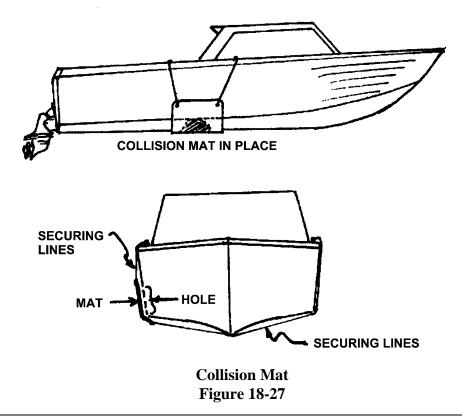
Patching holes below the waterline is usually a difficult task because of the pressure exerted by the water and the inaccesibility to the holed area. Patch small holes from the inside. Place some type of material over the hole and hold it in place with another object. For example, if the boat were holed in the bottom, place a PFD or seat cushion over the hole and hold it in place with a gas can, cooler, or tool box.

K.7. Large holes below the waterline

Large holes below the waterline are extremely difficult to patch. The pressure of the water flowing through the hole will not usually allow a patch to be installed from the inside.

K.7.a. Collision mat

If a collision mat (a large piece of canvas or vinyl) is available, use it to patch a large hole. Follow the procedures below while placing the patch over the hole (See figure 18-27).

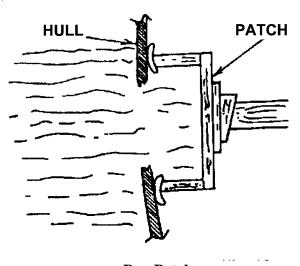




Step	Procedure
1	Tie four lines to the corners of the patch.
2	Position the patch by dripping the patch over the bow.
3	Have someone walk down each side of the boat, two of the lines
	for each person.
4	Slide the patch along the bottom of the boat.
5	Once the patch covers the hole, secure the four lines topside. The
	pressure of the water against the patch will also help to hold it in
	place.

K.7.b. Box patch

Box patches are effective, even on holes that have jagged edges protruding inward. The box patch is usually aprefabricated box, which is held in place with screws, nails, or it may be wedged in place with anything available. Put a gasket (anything available) between the box and the hull to make a good seal and to prevent the box from shifting (See figure 18-28).



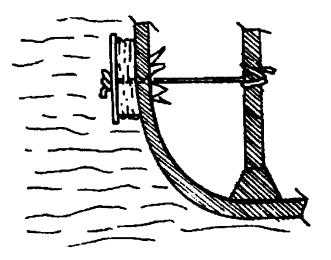
Box Patch Figure 18-28

K.8. Holes above the waterline

Holes above the waterline may be more dangerous than they appear. As the boat rolls, they admit water into the boat above the center of gravity. This water reduces the stability of the boat. Use plugs or patches on the inside or outside the hull to cover these type of holes. The following procedure is an effective method for patching holes above the waterline.



Step	Procedure
1	Use a pillow or cushion that has a small hole punched in the
	center.
2	Place the cushion over the holed area from the outside and back it
	with a board of the same approximate size. The board should also
	have a small hole through the center.
3	Pass a line through the board and cushion and knot the end of the
	line outside the board.
4	Secure the entire patch by attaching the other end of the line to
	something firm inside the boat (See Figure 18-29).



Patching Hole Above Waterline Figure 18-29



Patching Cracks

K.9. Cracks in hulls

To patch a crack in the hull, use the following procedures.

Step	Procedure
1	Stuff the crack with something pliable such as a rag or line.
2	Place a piece of canvas or rubber over the crack to serve as a
	gasket.
3	Back the patch with a solid object such as a piece of plywood,
	panel door, or similar material.
4	Use nails, screws, or wedges to hold the patch in place.

To prevent the crack from traveling, especially in fiberglass, drill joles at each end of the crack. These holes will relieve the pressure at the ends of the crack, Permitting the hull to flex without extending the crack.

